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PERFORMANCE OF F_1 HYBRIDS FROM INTRAHIRSUTUM CROSSES OF UPLAND COTTON

MOHAMMAD JURIAL BALOCH, GHULAM HUSSAIN TUNIO AND ABDUL RAHIM LAKHO

Cotton Research Institute, Sakrand, Pakistan

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Study was conducted to estimate the magnitude of heterosis for seven important characters of intrahirsutum F_1 hybrids. The characters studied included, yield of seed cotton per plant, bolls per plant, boll weight, seed and lint indices. The data showed significant differences between mid parents and F_1 hybrids for all the traits except boll weight. The maximum positive heterotic response of F_1 hybrids over mid and better parents respectively were, 20.62 and 13.72% for seed cotton yield, 19.34 and 12.77% for number of bolls, 15.22-12.88% for boll weight, 3.25 and 2.35% for lint percentage, 7.62 and 2.74% for staple length, 4.22 and 2.44% for lint index. With respect to seed index, the maximum heterosis of 9.66% in F_1 over mid parent was recorded. Considerable amount of heterosis displayed by various traits suggested possibility of more improvement in these traits and number of bolls is the most important criterion for increasing cotton yield.

Key words: *Gossypium hirsutum*, Heterosis, Yield, Yield components.

Introduction

Although Pakistan stands among the top 5 cotton producing countries of the world, for the last several years, cotton yield has been stagnant and fiber quality relatively poor. This has severely affected the economy of the cotton industry in Pakistan by affecing its export abroad. The yield stagnancy could be attributed to continued adoption of conventional breeding methodologies from many decades. Thus, the time has come that alternative approaches must be explored allowing parents to be identified that when crossed must give higher yields in F_1 or transgressive segregants in subsequent generations. The present studies were carried-out for two purposes. Firstly, to evaluate heterosis in intrahirsutum crosses for hybrid production. Since 2 favourable systems, that is genetic and cytoplasmic male sterility are already available that eliminate the need for tedious and time consuming emasculation and pollination of male sterile lines by hand, therefore, hybrid cotton may be a practical dream some day. Secondly, promising material may be utilized in developing pure breeding lines.

Khan *et al.* [1] reported higher magnitude of variance attributable to general combining ability effects rather than specific combining ability suggesting that non-additive genes control yield, boll numbers and boll weight. Several other research workers have carried-out studies on intraspecific F_1 hybrids of *G. hirsutum* L. and reported that heterosis is manifested in both developmental and economic characters. Said *et al.* [2], Soomro *et al.* [3] and Khan and Aslam [4] also reported substantial amount of heterosis for yield and yield components. An average heterosis of 42% in yield over mid parent and several hybrids over better parents have also been reported by Baloch *et al.* [5].

Materials and Methods

The studies were carried out on the following F_1 hybrids and their parents:

1. Coker staple x B 557
2. Coker staple x Qalandri
3. B 557 x Qalandri
4. Super okra N1. Super hairy x stoneville-825
5. Super okra N1. Super hairy x NIAB-78
6. B 557 x 108 F
7. NIAB-78 x 108 F

All the crosses along with their respective parents were sown in a randomized complete block design with four replications at Cotton Research Institute, Sakrand. The row-to-row and plant-to- plant distance apart was 2.5 feet and one foot respectively and the length of row was 10 feet. Ten plants from each cross and parental lines were grown. At maturity central plants were taken as the experimental units, one plant on either side was treated as discard. Thus, only 8 central plants from each plot were taken as index plants for recording the yield of seed cotton per plant in grams, number of bolls per plant, boll weight (grams), lint percentage, staple length (mm), seed and lint indices.

The data were subjected to analysis of variance [6]. Heterosis was calculated as percentage increase (+) or decrease (-) of F_1 hybrids over mid and better parent values.

Results and Discussion

The mean values of the parents, mid parents, F_1 hybrids and heterotic response for all the traits under study are presented in Table 1. For seed cotton yield, three of the seven hybrids gave positive heterosis over mid-parent and two over

TABLE 1. HETEROSIS IN VARIOUS CHARACTERS.

Name of character	S. No.	Name of cross	Female parent	Male parent	Mid parent	Hybrid	Percentage increase (+) or decrease (-) of F_1 over	
							Mid parent	Better parent
Seedcotton yield per plant (grams)	1.	Coker staple x B 557	67.25	63.58	65.42	76.18	16.45	13.28
	2.	Coker staple x Qalandri	67.25	56.30	61.78	52.55	-14.94	-21.86
	3.	B 557 x Qalandri	63.58	56.30	59.94	72.30	20.62	13.72
	4.	Super okra x Stoneville-825	60.23	47.60	53.92	56.90	5.53	-5.53
	5.	Super okra x NIAB-78	60.23	48.33	54.28	53.68	-1.11	-10.87
	6.	B 557 x 108 F	63.58	74.18	68.88	59.00	-14.34	-20.46
	7.	NIAB-78 x 108F	48.33	74.18	61.23	57.90	-5.44	-21.95
		Cdi (5%) = 17.84				Mean:	0.97	-7.67
Bolls per plant	1.	Coker staple x B 557	24.70	21.63	23.17	27.65	19.34	11.90
	2.	Coker staple x Qalandri	24.70	19.90	22.30	20.50	-8.07	-17.00
	3.	B 557 x Qalandri	21.63	19.90	20.77	23.00	10.74	6.33
	4.	Super okra x Stoneville-825	18.40	16.83	17.62	20.75	17.76	12.77
	5.	Super okra x NIAB-78	18.40	18.43	18.42	18.40	-0.11	-0.16
	6.	B557 x 108F	21.63	20.73	21.18	21.05	-0.61	-2.68
	7.	NIAB-78 x 108F	18.43	20.73	19.58	22.45	13.10	8.30
		Cdi (5%) = 4.87				Mean:	7.45	2.78
Boll weight (grams)	1.	Coker staple x B557	2.73	2.85	2.84	2.95	3.87	3.51
	2.	Coker staple x Qalandri	2.73	2.83	2.78	2.55	-8.27	-9.89
	3.	B557 x Qalandri	2.95	2.83	2.89	3.33	15.22	12.88
	4.	Super okra x Stoneville-825	2.88	2.88	2.88	2.80	-2.78	-2.78
	5.	Super okra x NIAB-78	2.88	2.65	2.77	3.00	8.30	4.17
	6.	B 557 x 108 F	2.95	3.13	3.04	2.95	-2.96	-5.75
	7.	NIAB-78 x 108F	2.65	3.13	2.89	2.98	3.11	-4.79
		Cdi (5%) = Non-significant difference				Mean:	2.36	-0.38
Lint percentage	1.	Coker staple x B 557	34.08	34.10	34.09	34.23	0.41	0.44
	2.	Coker staple x Qalandri	34.08	33.95	34.02	33.88	-0.41	-0.59
	3.	B557 x Qalandri	34.10	33.95	34.03	34.08	0.15	-0.21
	4.	Super okra x Stoneville-825	34.45	34.25	34.35	33.65	-2.04	-2.32
	5.	Super okra x NIAB-78	34.45	33.85	34.15	34.10	-0.15	-1.02
	6.	B557 x 108F	34.10	33.50	33.80	34.90	3.25	2.35
	7.	NIAB-78 x 108F	33.85	33.50	33.68	34.60	2.73	2.22
		Cdi (5%) = 0.59				Mean:	0.56	0.46
Staple length (mms)	1.	Coker staple x B557	27.28	27.53	27.41	28.28	3.17	2.72
	2.	Coker staple x Qalandri	27.28	27.70	27.49	27.98	1.78	1.01
	3.	B557 x Qalandri	27.53	27.70	27.62	28.03	1.48	1.19
	4.	Super okra x Stoneville-825	24.85	27.75	26.30	27.63	5.06	-0.43
	5.	Super okra x NIAB-78	24.85	27.33	26.09	28.08	7.63	2.74
	6.	B557 x 108F	27.53	25.70	26.62	27.95	5.00	1.53
	7.	NIAB-78 x 108F	27.33	25.70	26.52	26.83	1.17	-1.83
		Cdi (5%) = 0.56				Mean:	3.61	0.99
Seed index (grams)	1.	Coker staple x B557	7.93	7.65	7.79	7.70	-1.16	-2.90
	2.	Coker staple x Qalandri	7.93	8.00	7.97	7.65	-4.02	-4.38
	3.	B557 x Qalandri	7.65	8.00	7.83	7.85	0.26	-1.88
	4.	Super okra x Stoneville-825	6.78	7.55	7.17	7.48	4.32	-0.93
	5.	Super okra x NIAB-78	6.78	8.53	7.66	8.40	9.66	-1.52
	6.	B557 x 108F	7.65	8.13	7.89	7.48	-5.20	-8.00
	7.	NIAB-78 x 108F	8.53	8.13	8.33	7.75	-9.96	-9.14
		Cdi (5%) = 0.56				Mean:	-0.30	-4.11
Lint index (grams)	1.	Coker staple x B557	4.10	3.95	4.03	4.08	1.24	-1.71
	2.	Coker staple x Qalandri	4.10	4.10	4.10	3.90	-4.88	-4.88
	3.	B557 x Qalandri	3.95	4.10	4.03	4.20	4.22	2.44
	4.	Super okra x Stoneville-825	3.55	3.95	3.75	3.80	1.33	-3.80
	5.	Super okra x NIAB-78	3.55	4.33	3.93	4.38	10.18	1.15
	6.	B557 x 108F	3.95	4.10	4.03	4.00	-0.74	-2.44
	7.	NIAB-78 x 108F	4.33	4.10	4.22	4.10	-2.84	-5.31
		Cdi (5%) = 0.20				Mean:	1.22	-2.17

better parent. Over mid and better parents, the maximum heterosis of 20.62 and 13.72% respectively was expressed by the cross B557 x Qalandri. In respect of number of bolls, four of the seven hybrids manifested positive heterosis over mid parent and better parents where the maximum heterosis of 19.34% over mid-parent and 12.77% over better parent were respectively expressed by the crosses Coker staple x B557 and Super okra x Stoneville-825. Similarly four of the seven hybrids expressed positive heterosis for boll weight over mid parent which varied from 3.11 to 15.22% and three hybrids over better parent that varied from 3.51 to 12.88%. Nevertheless, maximum heterosis of 15.22 and 12.88% were expressed by the cross B557 x Qalandri against mid and better parent respectively. Regarding lint %, the maximum heterosis of 3.25 and 2.35% over mid and better parents were respectively manifested by the cross B557 x 108F. For staple length, all the hybrids gave positive heterosis over mid parent and five of the seven hybrids over better parent, however, maximum heterosis of 7.63% over mid parent and 2.74% over better parent were expressed by the cross Super Okra x NIAB-78. Three hybrids expressed positive heterosis over mid parent and all the hybrids gave negative heterosis over better parent with respect to seed index. For lint index, the cross Super Okra x NIAB-78 manifested maximum positive heterosis of 10.18% over mid parent whereas over better parent, cross B557 x Qalandri gave the maximum heterosis of 2.44%. Several workers like Baloch *et al.* [5], Said *et al.* [2], Soomro *et al.* [3], Mirza *et al.* [7], Khan *et al.* [1], Khan and Aslam [4], Ahmed and Channa [8], Nazar and Khan [9], Nasir *et al.* [10] and Mithaiwala *et al.* [11] also reported substantial amount of heterosis in seed cotton yield, number of bolls, boll weight, lint %, staple length, seed index and lint index. Our results conclude that number of bolls was the most important component for seed cotton yield and the cross Coker Staple x B557 is the most desirable hybrid to be chosen for number of bolls, consequently for the seed cotton yield.

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